Netherlands Quality Agency
NQA

HAN_UNIVERSITY OF APPLIED SCIENCES | Academie Toegepaste Biowetenschappen en Chemie

HAN

Master Molecular Life Sciences

Limited study program assessment

February 2023

Summary

In September 2022 the Master program Molecular Science (MLS) was visited by an audit panel from NQA. MLS is a two-year full-time program. The program is taught in English at the main location in Nijmegen. The audit panel assesses the quality of the study program as **positive.** The panel also advises **positively** about the extension of the study duration to 120 EC.

Standard 1: Intended Learning Outcomes
The study program **meets** the generic quality requirements for standard 1. The panel concludes that MLS meets the requirements of the workfield and is at Master level. Besides this the panel appreciates that MLS has extra attention for specific skills (soft skills) which are needed in the work field. MLS ensured that the final qualifications meet the Dublin descriptors for masters programs. The six competences, covering both scientific and project management knowledge and skills as well as critical personal reflection and continuous search for improvement are vastly anchored in the program and final qualifications. The panel appreciates and values the specific profile of MLS. Finally, the panel concludes that the intended learning outcomes have come together with valuable input of the (international) professional work field. MLS stays in contact on a regular basis with the (international) professional workfield and relevant developments therein.

Standard 2: Teaching-Learning Environment
The study program **meets** the generic quality requirements for standard 2. The panel saw that the program contains a theoretical part and a practical part, focussed on the work field. In this way, students are significantly better prepared to show that they developed to apprentice project leader during their final proof of competence (graduation project). The panel concludes that the program supports students in developing hard- and soft skills. The panel concludes that the way of the admission process is shaped now, for a large part causes a good fit. Students find tutors easy-to-reach, emphatic and knowledgeable. The panel finds the composition and level of Education of the staff adequate. The expertise of and support by lecturers are highly rewarded by students. However, the alignment of all lecturers, mainly in terms of expectation management and organisational details could be improved. The panel finds this empowered by some students who found that the teaching approach varies a bit, especially between guest lecturers and HAN-lecturers. The panel advises therefore to align that a bit more, maybe with intervision.

Standard 3: Assessment
The study program **meets** the generic quality requirements for standard 3. The panel concludes that the assessment program is aligned with HAN assessment policies, and consists of the assessment of professional products, a theoretical exam and performances in professional practice. Also, the panel sees that the assessment criteria are clearly derived from the final qualifications and therefore concludes the validity of assessment is high. To assure reliability, MLS holds calibration sessions and applies the 4-eyes principle. The panel appreciates that significant parts of the assessments are anchored in the professional practice. The panel concludes both the board of examiners and the assessment committee are “in control” regarding the assessment of MLS. The panel highly appreciates that external examiners are present at final-assessment sessions. Finally the panel concludes the quality of the final project is guaranteed as well as the Master final level.

Standard 4: Achieved Learning Outcomes
The study program **meets** the generic quality requirements for standard 4. The panel concludes that all final master qualifications are assessed during the graduation project. The panel appreciates MLS's specific profile, with both scientific and project management skills. The panel has seen that graduation products are of high (Master) final level, useful and relevant. Both alumni and the workfield representatives told the panel they are very satisfied with the reached final level of graduates and their functioning in the workfield. They find that the strong program gives students a head start in their career.

Extension study duration to 120 EC
Based on the argumentation MLS provided and their oral explanation, the panel concludes that MLS meets *both* criteria and therefore the panel advises **positively** about the extension of the study duration to 120 EC.

Contents

Summary **2**

Characteristic Features of the Study Program **7**

Basic Data of the Study Program 7
Retrospective of the previous Accreditation 8

Standard 1 Intended Learning Outcomes **9**

Standard 2 Teaching-Learning Environment **13**

Standard 3 Assessment **20**

Standard 4 Achieved learning outcomes **24**

Extension study duration to 120 EC **26**

Final Conclusion **29**

Appendices **30**

Appendix 1: program for the site visit **31**

Appendix 2: examined documents **32**

Introduction

This is the assessment report of the Master Molecular Life Sciences offered by Hogeschool Arnhem Nijmegen (HAN). The assessment was conducted by an audit panel compiled by Netherlands Quality Agency (NQA) commissioned by the HAN. Prior to the assessment process the audit panel has been approved by the NVAO.

In this report NQA gives account of its findings, considerations and conclusions. The assessment was undertaken according to the *Assessment Framework for the Higher Education Accreditation System of the Netherlands* of NVAO (September 2018) and the *NQA Guideline 2019 for Limited Program Assessment*. To assess the requested extension of the study load to 120 EC, the panel used the *Protocol elongation of the regular study load* of NVAO (March 2022).

The site visit took place on September 21st, 2022. The audit panel consisted of:
Mr. prof. dr. J.T.P. (Hans) Derksen (chair/domain expert)
Mr. dr.ir. M. (Martin) Bennink (domain expert)
Mr. prof.dr.ir. R. (Richard) van Kranenburg (domain expert)
Mrs. F.A. (Firdaws) Badmus (student member)

Ms. ir. M. (Marga) Dekker, senior NQA auditor, acted as lead-auditor/secretary of the panel, assisted by Mr. R. (Rogier) van de Hoef MEd, senior NQA auditor.

The Master program Molecular Science is part of the audit cluster HBO Life Science & Chemistry. The audit panels of this cluster have been tuned in with each other, in the first place through the instruction of their members about the NVAO assessment framework.
The assessment criteria calibrated between Hobéon and NQA are part of this instruction. Beforehand, the tuning is guaranteed by the overlap between the composition of all the panels. In addition, taking into account that each assessment of a study program is an individual assessment, as a result of the overlap between the composition of the panels, there has been progressive reflection on previous site visits within the audit cluster when relevant. Furthermore, the tuning between panels is guaranteed by the support of the same panel secretary as often as possible, from NQA and other quality agencies, and by employing well-trained panel chairpersons.

Method of working of the panel and process
For the assessment, the study program offered a critical reflection with appendices. For the assessment of the achieved learning outcomes, the panel has studied fifteen graduate products of graduates who recently finished their studies. These fifteen graduate products have been selected from the list of alumni of the last two academic years. In this selection, the variety in grading, modes of study and learning paths have been taken into account.

Central in the assessment was the site visit by the panel, consisting of expert peers. Two weeks before the site visit the preliminary meeting was held, together with the document study at the location of the study program and the panel met already representatives of the study program, the so-called ‘preparatory audit’. In the preliminary meeting the panel members have been instructed about NQA’s method of working and about the *NVAO-Assessment Framework*.

In this meeting the panel members also discussed their tentative findings. During both the preliminary meeting and during the site visit, findings the panel members shared their findings with each other continuously. During the site visit the panel spoke with various stakeholders of the study program, such as students, lecturers (assessors) and representatives of the work field and it studied several documents: see appendix 2. At the final of the site visit the panel incorporated all the information it had obtained in an overall picture and in a tentative substantiated assessment. In the final oral feedback session the panel chairperson communicated the conclusive assessment and the major findings of the panel.

Staff members and students of the study program have had the opportunity to approach the panel (via mail) in confidence to bring to the attention of the panel those matters they deem of importance to the assessment. No one used this opportunity.

After the site visit a draft report was formulated, which was presented to the panel. On the basis of the panel's input a second draft was made, which was presented to the study program for a check on factual inaccuracies. The panel members have taken note of the reaction of the study program and if necessary, adapted the report. Subsequently, the report was established as definitive. With all information provided (orally and in writing) the panel has been able to make a deliberate judgement.

The audit panel declares that the assessment of the study program was carried out independently.

Utrecht, *2 February 2023*

Panel chairman	Panel secretary
	
Mr. prof. dr. J.T.P. Derksen	Ms. ir. M. Dekker

Characteristic Features of the Study Program

In 2020, the organizational structure within HAN changed and the four faculties were restructured into fourteen schools (Academies) according to their professional orientation. The central goal underlying this reorganization was to facilitate the interaction in the triangle of education, research, and professional field. In accordance, the Bachelor education programs within the newly generated HAN schools, were integrated with the research units (lectorates), master programs and courses.

The Master Molecular Life Sciences (MLS) is a program tailored to meet the needs of organizations active in (applied) research and/or product development (R&D) in Life Sciences. Students deepen their knowledge in life sciences and learn to plan, carry out and manage project in the field, thereby contributing to the efficiency and effectiveness of project. To this final, they develop a blend of research, project management, writing and professional skills. The hands-on education is shaped by a combination of theory modules and learning in the professional context ("workplace learning") throughout the curriculum. This workplace learning is realized by a long-term internship for the full-time students and learning at the workplace for the part-time students. To ensure that the learning goals are promoted at internships/workplaces, MLS defined detailed and specific criteria for the performance of students at different stages of the education. In addition, students produce several professional products in the context of their internship / workplace. The MLS staff supports students with a variety of lecture activities and is responsible for assessment. Internship/workplace supervisors support students with their specific field expertise and provide them feedback according to the predefined criteria. Regular (online) meetings between student, internship/workplace supervisor and a personal HAN supervisor manage mutual expectations, as advised during the last visitation in 2016. MLS extremely values the strong involvement of the professional practice in the curriculum. The acquired qualifications of the graduates, both those with and without previous work experience, demonstrate the high quality of this education.

Basic Data of the Study Program

Name of study program as in CROHO (Central Register of Study Programs in Higher Education in the Netherlands)	Molecular Life Sciences
ISAT-code	49293
Orientation and level study program	Higher profession-oriented education (hbo)
Level study program	Master
For study programs in higher profession-oriented education, the addition which is used for the degree.	Master of Science
Number of study credits	120 ECTS
Variants	Full-time Part-time
Graduation courses / 'tracks'	No specific graduation tracks
Location(s)	Nijmegen
Teaching language	English

Retrospective of the previous Accreditation

The panel of the previous visitation had a few recommendations about Standards 2 and 3.

Standard 2:
The previous panel advised to further strengthen the expectation management of the student and especially of the companies involved and recommended that at least once before a student starts a graduation project at a new company, he or she should visit the location itself and the company supervisor, also abroad. MLS realized multiple contact moments throughout the curriculum in which expectations are discussed (see Standard 2).
The previous panel recommended implementing an evaluation after 1 or 2 years for several workshops that have recently started; for instance the writing skills workshop. MLS utilizes intensive evaluation cycles at the final of each module. In case of changes and new items introduced in the program, MLS specifically asks for students and staff feedback.
The previous panel recommended further professionalization of the intake of students, for example on their potential in the area of competences (the 'soft skills'). MLS have seriously taken up this advice and explicitly discuss the role of soft skills with prospective students. The current intake-process lead to overall good matches of students and program.
The previous panel recommended remaining alert to adjusting the curriculum in the case of new high-impact technologies such as Crispr/Cas-technology. MLS believes that through their intensive collaboration with the professional field, they pick up new developments quickly and integrate them if the overall program structure allows. Nonetheless, a more thorough update of the BoKS is scheduled from autumn 2022 onwards; see Standard 2.

Standard 3:
The previous panel recommended about the assessment evaluation committee: establish and determine the procedure for this. Since 2021 – 2022 a member of the MMLS core team is member of the assessment evaluation committee.
Finally the previous panel recommended that the remarks field should be used more actively on the assessmentform, so that it remains clear afterwards what the motives were of those involved in reaching their collective judgement. This aspect had and still has the attention of MLS. See: Standard 3.

Standard 1 Intended Learning Outcomes

The intended learning outcomes tie in with the level and orientation of the program; they are geared to the expectations of the professional field, the discipline and international requirements.

Conclusion

Based on the considerations mentioned below, the audit panel assesses that the Master Molecular Sciences study program **meets** the generic quality requirements for standard 1.
The panel concludes that MLS meets the requirements of the workfield and is at Master level. Besides this the panel appreciates that MLS has extra attention for specific skills (soft skills) which are needed in the work field. Although there are no national final qualifications, MLS ensured though that the final qualifications meet the Dublin descriptors for masters programs. MLS compared these with other programs in the field. In addition, MLS intensively discussed them with representatives of other masters programs of Universities of Applied Sciences in the domain of Applied Sciences. The panel concludes therefore that these alignments confirm that the final qualifications meet the (international) criteria for a master programs. Six competences, covering both scientific and project management knowledge and skills as well as critical personal reflection and continuous search for improvement are vastly anchored in the program and final qualifications. These are vastly anchored in the program and final qualifications. The panel appreciates and values the specific profile of MLS. Finally, the panel concludes that the intended learning outcomes have come together with valuable input of the (international) professional work field. Via their external examiners and alumni, MLS stays in contact on a regular basis with the (international) professional workfield and relevant developments therein. MLS organizes also regularly planned meetings where workfield representatives give input on the learning outcomes, the curriculum and assessments.

Substantiation

Professional orientation

The overarching learning outcome of MLS is that graduates are able to plan and control R&D projects of a duration of at least three months in life sciences. To this final, they combine several central skills, namely skills in research and product development, managing projects and communication. In addition, students develop the ability to guide their own professional development. MLS has chosen to describe this profile with the following three professional tasks.

An MLS graduate is able to:

- understand practical, economic, social and/or ecological needs of businesses, market and society that can be anticipated by biotechnology;
- apply fundamental knowledge in the area of molecular life sciences to find sustainable solutions for these needs;
- implement such solutions in a successful and efficient way by organizing their realization in projects, considering the interdisciplinary dimension and communicating with different experts.

The MLS qualifications are categorized in a set of six competences. These competences are specified by means of indicators and placed in the framework of the Body of Knowledge and Skills. The competences in the life sciences context are the scaffold of the MLS program and are defined as follows: 1. Professional conduct and guiding professional development, 2. Designing

strategies for applied research and product development, 3. Design, control and analysis of experiments, 4. Communication, 5. Managing projects and 6. Advising. Competence 1 forms the basis for a professional masters graduate who is contributing his/her expertise and efforts towards the common goals of an organization and society. This competence also anchors professional behavior and development in graduate profile of MLS. Competences 2 and 3 focus on the research skills required for applied research and product development in the bioscience sector. These research skills are the core of the MLS profile, because graduates will work on research projects in the life science sector. Competence 4 focusses on effective communication in writing and speaking to different stakeholders in English. Competence 5 focusses on the project skills needed for effective and efficient execution of projects, and complements competences 2 and 3 in the planning and control of projects in the life science sector. The ability to collect and integrate various information and to use this to advise about own and related project topics is underlined by competence 6.

Final qualifications
The panel has seen that there are no nationally defined final qualifications in the domain of applied biosciences at master level. MLS ensured though that the final qualifications meet the Dublin descriptors for masters programs. MLS compared these with other programs in the field. In addition, MLS intensively discussed them with representatives of other masters programs of Universities of Applied Sciences in the domain of Applied Sciences. The panel concludes therefore that these alignments confirm that the final qualifications meet the (international) criteria for master programs.

Specific profile
The panel sees that graduates contribute to the effectivity and efficiency of projects in the life sciences sector. Technological advances in that sector have led to an enormous increase in generating knowledge within the last decades. It is essential to translate this knowledge into new products and solutions beneficial to society in an effective and efficient way. This illustrates the complexity of product development in the sector, not only considering scientific, but also legal, practical and market requirements. Organizations feel the need to act as effectively and efficiently as possible to minimize time and other resources. This requires staff with the appropriate mindset and skills. Such staff must combine scientific knowledge and skills, insights into product development phases and requirements, good practical (experimental) skills and experiences as well as project (management) skills. This way, these professionals form the linking pin between theory and practice, laboratory staff and management and various departments. The profile of a MLS graduate describes this linking pin that contributes to the effectivity and efficiency of projects in the life science sector (see figure 1).

A comparison of the qualifications of MLS with other graduates in the sector, such as the Bachelor and Master of academic universities, shows how these graduates complement each other in the field Skills MLS considers awareness of one’s own individual personality and how this contributes to professional behavior as well as continuous professional development as key features of a master professional in the complex and ever-changing life science sector. This is also acknowledged by professional contacts. Therefore, critical personal reflection and continuous search for improvement is vastly anchored in the program and final qualifications. The panel recognized this clearly in for instance the program, and compliments MLS with this specific profile.

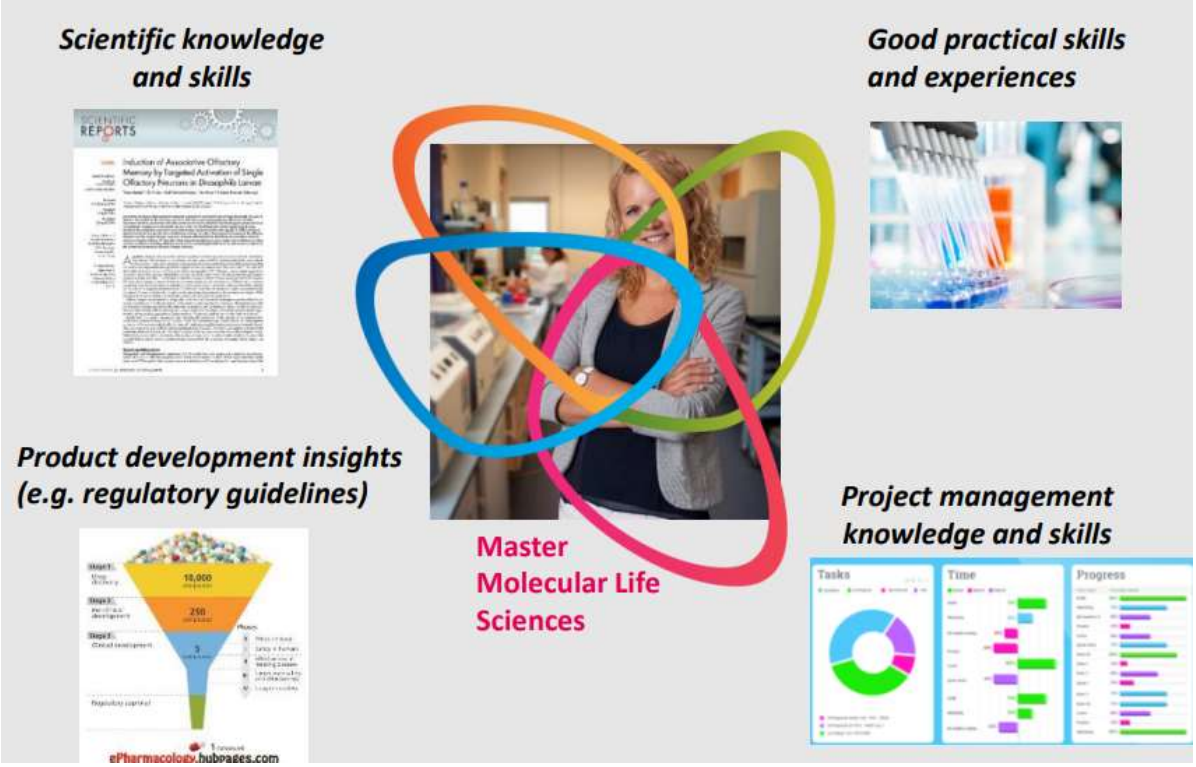

Figure 1 The graduate profile of the Master MLS depicted as the linking pin, combining scientific knowledge and skills, product development insights, as well as good practical skills and experiences with project management knowledge and skills; thereby contributing to the effectiveness and efficiency of projects in the life science sector.

Tuning with the (international) work field

MLS regularly discusses the final qualifications and curriculum with the rapidly evolving life science sector. This is achieved with several representatives of the sector who are members of the professional field advisory board, and a large professional network including the internship / workplace supervisors of the students. In January 2022, MLS systematically revised the description of the final qualifications with the advisory board. Overall, the graduate profile is highly appreciated as it matches with the needs of organizations active in R&D in life sciences. Suggestions for fine-tuning were made. These were well recognized by MLS as they reflect experiences MLS had in interaction with students and the professional field. Based on this, the final qualification description was clarified. For example regarding the graduates' role in recognizing patent and market opportunities. In addition, the professional field advisory board suggested to give 'big data' a more prominent place in the curriculum which will be realized in the prospective program update. MLS also regularly asks internship/workplace supervisors whether the program matches with their needs and expectations. Overall, their reactions are very positive. Supervisors especially appreciate the practical, applied and project-based character, and the integration of project management and personal reflection in the research-based program. A survey among recent alumni shows that the knowledge and skills provided by the program is relevant to them in their current positions. Therefore, MLS believes that their intensive interaction with the professional field confirms that the MLS-profile is tailored to the needs of organizations for (applied) research or product development in Life Sciences. The panel agrees with this, which is strengthened by similar comments the panel heard from alumni, workplace supervisors and external committees (in Dutch: externe gecommiteerden) with whom the panel spoke. The panel appreciates the continuous evaluation of their own learning-goals and the discussion on expanding, broadening the scope of the education and the risks thereof.

An important feature of the life science sector is the many collaborations across borders and the international composition of staff. In accordance, MLS prepares the students for a position in a global setting. Therefore, the MLS-program is entirely offered in English and actively recruits international students. Via contacts with international companies (for example Roche in Switzerland), MLS continuously verifies the program with their needs. As a result, graduates are well prepared for an internationally oriented career. The HAN Strategic Policy 2022-2028 supports the international embedding of the MLS program.

Standard 2 Teaching-Learning Environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Conclusion

Based on the considerations mentioned below, the audit panel assesses that the Master Molecular Life Sciences study program **meets** the generic quality requirements for standard 2. The panel saw that the program contains a theoretical part and a practical part, focussed on the work field. In this way, students are significantly better prepared to show that they developed to apprentice project leader during their final proof of competence (graduation project). For a successful role as starting project leader of life science projects, a blend of research, project management and writing skills as well as professional conduct and guiding professional development are key elements for the graduates. The panel concludes that the program therefore supports students in developing hard- and soft skills.
The panel is impressed about the way of selection of students and the fit with the workplace. The panel concludes that the way of the admission process is shaped now, for a large part causes this good fit. In general, students are satisfied with their tutor. They find tutors easy-to-reach, emphatic and knowledgeable. The panel finds the composition and level of Education of the staff adequate to provide students with an education at Master level. The expertise of and support by lecturers are highly rewarded by students. However, the alignment of all lecturers, mainly in terms of expectation management and organisational details could be improved. The panel finds this empowered by some students who found that the teaching approach varies a bit, especially between guest lecturers and HAN-lecturers. The panel advises therefore to align that a bit more, maybe with intervision.

Substantiation

Structure and design of the program

Structure

During the first 1.5 years, all students follow a theoretical program, comprising of the modules: Fundamentals, Drug Development, Production of Biomolecules and Vaccines and Diagnostics. With this MLS aims to provide students a broader base in knowledge and general skills. In addition to this theoretical program, students are steered to learn in their professional context throughout the curriculum. Full-time students do this in their internship, part-time students in their own workplace. The modules anchored in the professional context (workplace learning modules) are Research and Product Development Skills, Managing Projects, and the Graduation Project.

During the first 1.5 years, full-time students spend three days a week on their internship, one day a week on HAN-guided class activities, and one day per week for self-study/working on their assignments. Part-time students combine the two days for HAN classes and self-study/working on assignments with their own job, on which they meet the requirements for the workplace learning modules. The graduation project comprises five days a week for half a year, or longer if carried out part-time. Both student populations are combined in one classroom, but the pace to achieve workplace learning goals for part-time students can vary. This is mainly influenced by the

match of priorities at the workplace with priorities of the education program. Accordingly, the regular study duration for full-time students is 2 years and for part-time students 2-4 years.

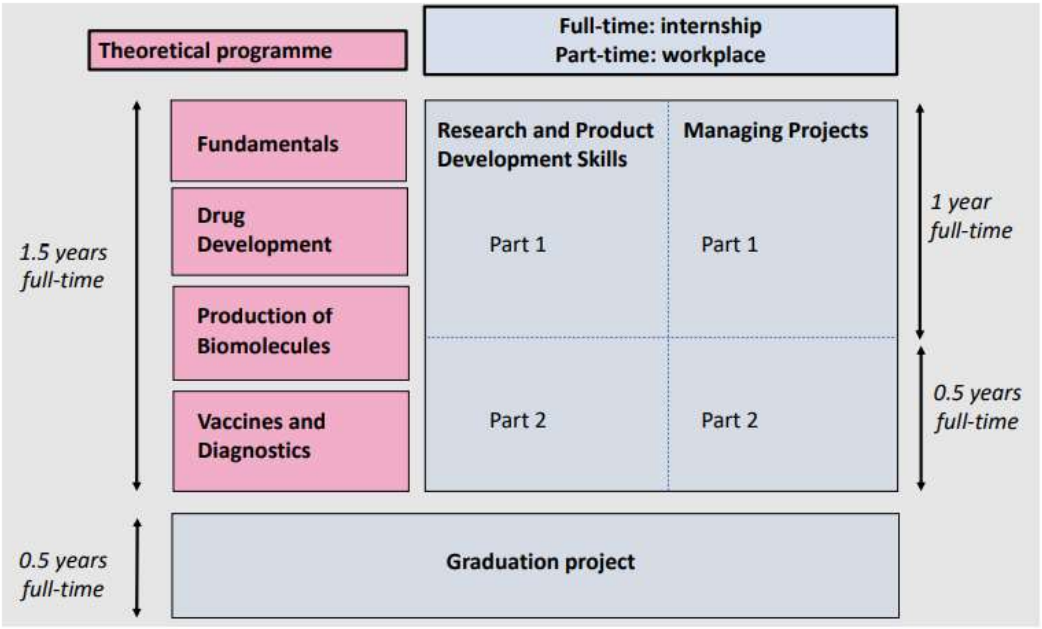

Figure 2, Scheme of the curriculum for full-time and part-time students. The modules Research and Product Development, Managing Projects and the Graduation Project are anchored in the professional context for each student (internship for full-time students and workplace for part-time students), and is supported by dedicated education activities.

Workplace learning is guided by several performance assessments defined by specific indicators, and assignments resembling professional products. MLS supports students in their workplace learning by various in-class activities and personal supervision. Before 2016, the curriculum did not comprise learning in the professional context prior to the graduation project. Back then, MLS noticed that students were not always able to apply and practice their newly acquired knowledge and skills at their workplace until this was specifically requested in this last phase of the curriculum. Therefore, MLS designed a curriculum of 120 ECTS and trained students better in skills needed for the professional context prior to the graduation project. Currently, MLS observes that students are significantly better prepared to show that they developed to apprentice project leader during their final proof of competence (graduation project). The representatives of the professional field endorsed this strongly to the panel.
MLS highly appreciates learning in the professional environment; however, MLS sees that the variety of professional contexts also leads to variations in learning opportunities for students. MLS takes control of this by requesting internship descriptions and discussing expectations with all students and supervisors. When learning outcomes cannot be realized by part-time students, MLS supports students in finding an alternative professional context. This way, MLS guarantees that the requirements for suitable professional environments are met.

Relation with intended learning outcomes: Knowledge and skills development
The panel noticed that students acquire knowledge and skills in a very hands-on manner: they continuously develop towards performance goals and work on assignments and cases that force them to apply and integrate knowledge and skills. The assignments are anchored in the students' professional practice and complemented with job-relevant cases offered in the context of the

theory program. MLS ensures that the performance goals and assignments cover the set of competences and Body of Knowledge and Skills (BoKS) by annually mapping the relation between the BoKS and the assignments. In addition, MLS verifies the professional relevance of these products with the professional advisory board.
MLS has selected drug discovery and development, biomolecule production and vaccine and diagnostic test development as specific context areas for the theory modules since these are important areas of the life science sector in the region and beyond. With this context, MLS also aims to teach students a helicopter view of aspects that play a role in different applications of the product development pipeline in life sciences. Both the panel and students appreciate the content that MLS selected to acquire the proper knowledge and skills; it is up-to-date and relevant to professional practice]. Alumni recently indicated that the knowledge offered in the education program contributed to their development at master level. They did so towards the panel too.

In January 2022, MLS asked the professional field advisory board for feedback on the BoKS. Overall, the representatives were very positive about the representation of the various aspects in the BoKS and considered them relevant for the professional environment. MLS was advised to add more 'big data analysis', synthetic biology and other cutting-edge technologies to the BoKS in the near future. The panel supports this. This will be instead of other (detailed) knowledge of specific subjects, as it is considered most important that graduates have an overview of relevant topics and available technological options. Starting in 2022-2023, MLS will update the BoKS based on this feedback and adapt the program accordingly. In this process, MLS also strives for (a limited number of) elective modules/assignments giving students the choice to specialize in a certain context, as has been suggested by supervisors, students and alumni. The panel appreciates highly that MLS is listening carefully to the students, alumni and workfield to keep their education up-to-date. Up till now, such elective modules were not feasible due to low student numbers and financial constraints. With the funding of the 120 ECTS in full, tailoring the program to meet the needs of the students and the professional field will be more feasible.

Core skills: Research, Project Management, Scientific Writing and Professional Development
For a successful role as starting project leader of life science projects, a blend of research, project management and writing skills as well as professional conduct and guiding professional development are key elements for the graduates. The panel concludes that the program supports students in developing these skills. To train their research skills, MLS offers assignments that challenge students to select, critically interpret and combine information from scientific literature, to set out multistep research strategies and to interpret and discuss results in a scientifically sound manner. The panel finds that the research and development skills are well embedded in the assignments throughout the modules. In addition, students develop their research skills in their own professional environment by working towards the goals and criteria defined by performance indicators. They are supported in this by interactive classes at HAN, their workplace supervisors, and by progress meetings between workplace supervisor, HAN tutor and student..
Writing (scientific writing) is closely linked to research skills and one of the core skills of a project leader. To support students in the development of their (scientific) writing skills, MLS offers dedicated workshops and feedback, supported by their own tailor-made, online writing guide. However, MLS previously noticed that students kept struggling to structure and write their reports in a correct and transparent way. On top of this, the lecturers found it challenging to give students the explicit feedback that helped them to improve their scientific writing. MLS kept discussing the problems with the lecturer dedicated for writing and had some calibration sessions. By the

student year group of 2019, the scientific writing lecturer had developed very explicit criteria that helped students to guide and check their writing and support the MLS staff in identifying writing problems and giving specific feedback. MLS is proud that this finally led to an improvement of the quality of the written products of most of the students. The panel endorses this. The project management training consists of a series of 'hard skills' trainings culminating in a project proposal and work plan, and a series of 'soft skills' (communication skills and interpersonal effectiveness) trainings. Starting point is that these project management skills are supportive to the effective and efficient planning and realisation of projects in various organisations of the life sciences sector. To this final, MLS chooses for general approaches in the trainings, which can be translated to specific tools that might be used by individual organisations. The hard skills development is trained by writing a project proposal and plan, including a detailed description of deliverables, risks, communication plan, etc, for a realistic project in the own professional context. Students highly appreciate the way they are taught to write such a project plan and MLS recognizes its effectivity in the quality of the graduation project proposals. Calibration sessions and discussions helped to improve expectation management towards students and to align in the assessments.

The soft (interpersonal) skills development is started with the "Professional Toolbox" training and assessment, followed by the training and assessment of "Professional Effectiveness". Both parts are taught at HAN during interactive sessions, while development is mainly anchored in the professional environment with monitoring of progress at regular intervals. This focus on soft skills is much appreciated by the professional field. The panel asked representatives of the professional field and they fully endorsed this. During the last six years, MLS continuedly searched for the best way to clarify expectations and to maximally support students in their development. MLS did this by redefining (assessment)criteria and/or adding tangible descriptions to them, and adapting their education activities. Over the years, MLS saw that students became more confident in the development and application of their interpersonal skills. Students highly appreciate the project management training and alumni rate this program aspect as one of the most meaningful for their future career. They told the panel this too. We believe that professional conduct and development of students are important criteria for success. Therefore, MLS anchored these aspects as part of the Managing Projects module recognisably in the program. MLS regularly receives feedback from the professional field / supervisors expressing their appreciation for this focus on personal skills. However, MLS also noticed that these activities do not come natural to the students, and that logical integration and offering a 'no nonsense' method are key for them to experience such activities as useful. While in the past, professional skills development was a separate line of teaching (and assessment for year groups 2016 and 2017), it is currently embedded within the performance evaluations of the research and managing project skills at the internship/workplace. In addition, it is a compulsory subject of the progress meetings between student, HAN tutor and workplace supervisor that take place at least once per semester.

Internationalisation
Since MLS has students from different nationalities in the program and because English is the dominant language of science, lectures and course materials are given in English only. Many of the lecturers have international experience and two of the staff members are native English. One of the modules is offered in collaboration with the University of Florida where MLS provides students an online platform to study for 3.5 EC in an international classroom in a module of the master's program Pharmaceutical Chemistry. MLS-students perform well in the international setting. They achieve high grades, can communicate effectively in English, and understand the

international standards and conventions of scientific research. More importantly, they demonstrate an independent and critical learning attitude, a characteristic which was also noticed by the University of Florida.

Design of the program

Didactic concept
MLS believes that learning in the professional context is most effective. Therefore, MLS places the students in this context as much as possible. The panel appreciates that MLS uses assignments relevant to the workplace context and performance indicators to monitor development from bachelor to a master graduate. Students mainly work individually on assignments in preparation for the responsibilities they will face with future projects. Working towards these assignments and performance indicators is the core of each student's learning process. As such, MLS's education is based on competence-development. MLS supports learning with various activities: (Guest)lecturers and self-study activities for knowledge transfer, skills trainings (for example, for bio-informatics or project management), feedback sessions in class and individually with their workplace and HAN supervisor. Student evaluations show that their satisfaction with the didactical means of the program varies. Students also indicate that it is hard for them to get clarity about expectations of assignments and they often do not see the connection between various teaching activities and assignments. During the last year, MLS noticed that the change in student population including freshly graduated bachelors, led to changes in attitude and way of learning. In addition, the program setup is complex with modules and various activities and assignments running in parallel. Students can be overwhelmed by the various expectations, and to some extent, are less intrinsically motivated to engage and get clarity about expectations. Changes in attitude and learning style are also reported by other masters' programs within HAN and might therefore relate to a more general phenomenon of a changing society. After realising this, MLS started critically reviewing the didactic approaches, especially considering the target group, the program setup and the multiple learning goals to be achieved. In a first meeting systematically discussing this MLS concluded that it is key to facilitate students to focus and gain clarity on tasks and assignments, and to support them in becoming confident to think independently and take decisions. MLS wants to do this by more consistently taking roles as mentors during student-driven meetings to work on assignments. This will also help them to get started with tasks during busy periods. In addition, MLS feels that their approaches in information transfer (classical lecturing, flipped classrooms etc) are ready for systematic review. MLS will follow-up on this, in contact with students, during the program review in 2022-2023. This will also involve finding the ideal blend between online and face-to-face education. Some students told the panel they miss interaction with fellow students. The panel suggests MLS could consider more group activities. For example: the soft skills development of students could be possibly done more together?

Admission
The panel is impressed about the way of selection of students and the fit with the workplace. The panel concludes that the way of the admission process is shaped now, for a large part causes this good fit. Admission of (international) students is tailored to different target groups. The previous panel advised to professionalize the intake procedure to specifically recruit students with potential for developing the (soft) skills typical for the MLS program. MLS did this by carefully interviewing every individual before entering the program. During these interviews, MLS

addresses mutual expectations, background of the student and the match with the program. Based on this, it is possible to give a custom-made advice to each student. Sometimes MLS advises the students to prepare for the program by refreshing basic knowledge in areas of the curriculum. With prospective full-time students, MLS also discuss options for internships and support the students in finding one by using their network. In doing so, it is of great importance to select students that match with the skill set of the program and the expectations and culture of an internship organization. MLS does this by negotiating with partners and interviewing candidates carefully. In addition, internship organizations have personal interviews with candidates before they decide to hire a prospective student. In general, the procedure leads to a good match between student and program. MLS is fine-tuning their information and selection continuously. Sometimes applicants have international diploma's officially matching with the admission criteria, but their actual qualifications and experience do not match. To decide whether they are eligible, MLS requests detailed information about their lab research experience, interview them and/or request a research assignment. Alternatively, applicants may have the requested qualifications without possessing the respective diplomas. MLS has experienced this with professionals with a 'technicians' education' from Germany or Switzerland. MLS developed an admission assessment for such applicants in which they can demonstrate their qualifications equivalent to Bachelor level Previously, MLS experienced mismatches and dropouts of certain (international) target groups. After having learned from this, MLS is confident that the current recruitment and selection process leads to a diverse student population that can complete the study program within a reasonable time frame.

Learning paths
Most full-time students are freshly graduated bachelors, while most students with professional experience follow the part-time program. The ratio between full-time and part-time students is about half/half annually. The total number of students increased from 14 in 2016 to 28 in 2021. To make sure that bachelor students without work experience can reach the graduate qualifications, a 120 EC study program is needed. Professionals with work experience after completing their bachelor can receive exemption for certain parts of the workplace learning modules. In this way, their professional development regarding R&D skills and their professional toolbox are accredited, while MLS can fully focus on these 'basics' with students without experience. The graduation records and survey among alumni demonstrate that this setup enables both groups to reach their graduate profile and move forward in their career (see also Standard 4).

Tutoring
At the start of the program, all students are assigned to a personal MLS. This tutor has multiple roles in monitoring and supporting the student's study progress. Two to four times per academic year, performance and professional development of the student are discussed during progress meetings between student, workplace supervisor and HAN tutor. In addition, the tutor is involved in the assessment of certain workplace-specific assignments. Finally, this person is the first point of contact for all kind of job-related and personal issues. In general, students are satisfied with their tutor. They find tutors easy-to-reach, emphatic and knowledgeable.

Staff
The panel finds the composition and level of Education of the staff adequate to provide students with an education at Master level. MLS is a small education program with a staff size of about 2.0

full-time units. It's steered by a core team of three people sharing the main responsibilities of the program, such as coordination of the educational units, quality assurance, marketing, human resources and interaction with the professional field and internship coordination. As such, the core team already meets the requirements of the HAN-coined 'results-responsible team'. The transition to work with such teams is currently ongoing within the School of Applied Biosciences and Chemistry. Due to the program profile, MLS needs a rather wide diversity of expertise in their lecturers, ranging from various fields of life sciences to for instance statistics, project management and business development. All required lecturer qualifications are mapped into a matrix and matched with the team of lecturers. All lecturers have experience in professional practise, either through previous jobs or current activities. Due to the required diversity in expertise and to avoid vulnerability, the staff hours are distributed over a relatively large number of lecturers. The expertise of and support by lecturers are highly rewarded by students. However, the alignment of all lecturers, mainly in terms of expectation management and organisational details. The panel finds this empowered by some students who found that the teaching approach varies a bit, especially between guest lecturers and HAN-lecturers. The panel advises therefore to align that a bit more, maybe with intervision. This challenge is exacerbated by the growth of the team during the last years (from about 1.3 to about 2 fulltime units) and the change-to-improve-prone culture. Lastly the fact that most lecturers have their main appointment elsewhere, namely at the bachelor courses within the School of Applied Biosciences and Chemistry, the HAN BioCentre, or external. The corona-pandemic and related measures also affected performance and (informal) communication of staff. MLS is continuously searching for ways to deal with these challenges. Next to the core team, MLS installed a team of tutors responsible for student supervision, mainly in terms of workplace learning. The tutors also have contact with the workplace supervisors. This role requires timely (re)actions and in the past, MLS saw that this was not always feasible when tutors had many other duties elsewhere. MLS acted upon this by changing the team of tutors. To align with each other, MLS discusses students' progress and diverse issues of the workplace learning during meetings with all tutors once every six weeks. The core team meets once every fortnight to discuss ongoing issues and agree on follow-up actions, often including communication with other team members, students, or external stakeholders. Starting from 2022-2023, MLS will change the responsibilities for some course units and adapt the meeting structure accordingly. MLS hopes that this will further help mutual alignment of lecturers and clear communication towards students and workplaces. MLS is content how their staffing guarantees an up-to-date program relevant to professional practice. The total formation covers the required expertise. In general, students confirm the high quality, enthusiasm and engagement of the staff in various evaluations. Alumni recently rewarded the quality of lecturers with an 4.0 on a scale of 5.

Facilities

The panel finds that the HAN campus provides classrooms with modern, relevant educational facilities and the opportunity to offer classes online and/or in hybrid format. The latter is realized by using MS Teams connections, supported by high-quality speakers and/or camera, or a Bluejeans conference system at the HAN campus. Laboratories and laboratory-specific equipment are available at the HAN campus, but mostly provided by the internship/workplace environment of the individual student.

Standard 3 Assessment

The program has an adequate system of student assessment in place.

Conclusion

Based on the considerations mentioned below, the audit panel assesses that the Master Molecular Life Sciences study program **meets** the generic quality requirements for standard 3. The panel concludes that the assessment program is aligned with HAN assessment policies and consists of the assessment of professional products, a theoretical exam, performance assessments and the final assessment meeting. Also, the panel sees that the assessment criteria are clearly derived from the final qualifications. The panel finds that all the assessment criteria are derived from the final qualifications and therefore concludes the validity of assessment is high. To assure reliability, MLS holds calibration sessions and applies the 4-eyes principle. The panel appreciates that significant parts of the assessments are anchored in the professional practice. The panel supports the efforts MLS is taking, and encourages them to keep improving the quality and quantity of feedback of assessors on the assessment forms.
The panel concludes both the board of examiners and the assessment committee are “in control” regarding the assessment of MLS. The panel highly appreciates that external examiners are present at final-assessment sessions. Together with the consequent usage of other guarantee mechanisms as the 4-eyes principle, calibration sessions amongst examiners, assessment training for examiners and sampling of the final projects by the board of examiners, the panel concludes the quality of the final project is guaranteed as well as the Master final level.

Substantiation

Assessment policy

The panel concludes that the assessment program is aligned with HAN assessment policies and consists of the assessment of professional products, a theoretical exam and performances in professional practice. The panel also concludes that the assessment criteria are clearly derived from the final qualifications. The panel compliments MLS how insightful it is which competences / BoKS are assessed by which exam. The relations “competences – curriculum” and “BoKS – curriculum” are therefore clear. This overview helps MLS to stay in control of assessing the complete set of competences and BoKS by the curriculum. Finally, the panel concludes that all competences are integrally assessed in the graduation project. MLS strives to assess all criteria at least once before the graduation project commences. The panel concludes that assessment criteria for all exams and products of the modules Fundamentals, Drug Development, Production of Biomolecules, and Vaccines and Diagnostics are derived from competence indicators and placed in the context of the respective BoKS. The assessment criteria of the modules Research and Development Skills, Project Management and Graduation Project are mainly based on the competence indicators.

The panel concludes that all the assessment criteria are derived from the final qualifications and therefore concludes the validity of assessment is high. To assure reliability, MLS holds calibration sessions and applies the 4-eyes principle. Nonetheless, students have told both MLS-staff and the panel they have the impression that different lecturers assess differently. When MLS receives

such feedback, they execute additional verifications. If applicable in incidental cases, MLS corrects their marking. In general, assessors feel that they mutually agree on their marking. Students have told the panel they have the impression that there are differences in phrasing in instructions and feedback. For example: should the focus be on content or writing style. Further professionalization in giving consistent feedback is a goal to be included in the Senior Qualification of Examinations (SKE). The panel appreciates the efforts of MLS herein. According to evaluations, students also feel that expectations from assignments are often not clear to them. Students have told the panel this also. To achieve more transparency in the assessments, MLS regularly rephrased assessment criteria to avoid ambiguity. This is often experienced as challenging as MLS is assessing complex tasks. MLS is constantly attempting to have the right balance between clarifying expectations to students on the one hand, and to challenge them with the complexity and uncertainty belonging to the master level. Therefore, MLS started student-driven teaching activities in which expectations and approach of tasks are discussed. Other master programs at HAN have positive experiences with this approach. The examination committee recently reviewed the assessment tools of MLS, and noticed that MLS uses multiple formats for their assessment forms. They questioned whether more uniformity would increase usability and transparency. More uniformity in assessment forms is also suggested by students. MLS has discussed this before with an education and assessment expert and came to the conclusion that different types of assessments (focussing on either knowledge or performance) can lead to different requirements for assessment forms. Still, the right balance between uniformity and fit-for-purpose of the assessment forms has the attention of MLS. MLS involved their Program Committee in the annual review of the assessment forms. MLS will critically review the formats of the forms during the review of the assessment program in 2022-2023.

Execution of assessment policy

Assessment in professional context

The panel appreciates that significant parts of the assessments are anchored in the professional practice. Each unit of study related to workplace learning contains assessment of professional products and performance assessments assessing the (daily) performance of students in practice. These performance assessments are related to research skills (research performance), professional toolbox and professional effectiveness of students. While certified lecturers independently assess the professional products, MLS depend on the input of the internship / workplace supervisors for assessment of the performance of students. Supervisors give their input in the form of evaluations (baseline and intermediate) and final assessments according to the detailed score sheets with performance descriptors. Still, MLS noticed that different background and workplace contexts can lead to variation in the interpretation of score sheets. MLS acts on this by different verification steps: discussing expectations with supervisors during the scheduled progress meetings, asking students to provide evidence together with the supervisor’s scores and then discussing all input during assessment meetings. The panel appreciates these verification steps and encourages MLS to continue and develop them further.

Feedback versus summative assessment

MLS believes that feedback (formative assessment) can greatly facilitate the learning process of students. It is structurally applied in the internship/workplace performance assessments by formally asking baseline and intermediate evaluations from workplace supervisors, which students can use as input for their professional development. It is harder for MLS to structurally implement formative assessments for professional products. This is due to the required time

investment and the fact that students often fail to submit complete drafts. Peer feedback is regularly hampered by confidentiality issues of internship/workplace-related products. At present, MLS deals with this challenge by offering feedback, discussions and/or question hours for some products, and by self-assessment tools for scientific writing. Still, students indicate that they would value more feedback, preferably formatively, but also summative feedback is appreciated. Students have told this to the panel too. In line with this, the NQA-panel advised MLS in 2016 to use the remarks field of the assessment forms more actively. MLS discussed this and noticed that often lecturers provide additional feedback and clarification of their marking. The panel has seen final projects though, where feedback was minimal (see: Recommendations). On the other hand, very detailed assessment forms in combination with time restrains withhold assessors to provide additional remarks. In the review of the assessment program in 2022-2023, MLS will also investigate whether they can relocate time-investment of lecturers from summative assessment to feedback. Such additional time-investment would be facilitated by the funding of a full 120 ECTS program. Possible changes in the assessment will be designed and implemented in concert with redesigning content and work formats of the curriculum. The panel supports the efforts MLS is taking, and encourages them to keep improving the quality and quantity of feedback of assessors on the assessment forms. Both to help their students improving and to make clear(er) how the assessors' judgement is translated in scores on the form.

Quality assurance

The panel has spoken with the chair and a member of the board of examiners (examen-commissie) and a member of the evaluation committee (toetscommissie). The panel concludes they are "in control" regarding the assessment of MLS. The board of examiners has the final responsibility to safeguard the quality of the assessment and is responsible for the (guarantee of the) quality of the education is at Master level. From 2020 onwards, MLS shares the examination board with the bachelor education programs within the School of Applied Biosciences and Chemistry. One of the MLS core team members is also a member of this examination board and of the assessment evaluation committee. Assessors of the MLS program are permanent staff members and are certified with the 'Basis Kwalificatie Examinering' (BKE). External lecturers or workplace supervisors provide examiners of MLS with advice based on their expertise using the specific assessment criteria. The quality of the exams is continuously verified by evaluations with students, calibrations among lecturers and discussions with the professional field. If required, improvement actions are initiated, for example by rephrasing the assessment criteria or clarifying the instructions. The complete assessment program will be reviewed under the lead of two core team members, who will be taking the SKE-course in 2022-2023.

Assessment and quality assurance of the final assessment

Two assessors assure the quality of the project proposal and the scientific report. The project management lecturer and assessor is regularly involved in the assessment of the portfolio and viva. The workplace supervisor has an advisory role, mainly concerning the mark for project work (workplace assessment). An external supervisor (Dutch: gecommitteerde), who has science and project management responsibilities in the professional field, is involved in each graduation assessment. This person verifies the assessment of the scientific report. In addition, he/she oversees the assessment procedure, is invited to ask questions to the candidate and validates the assessment of the MLS staff. Although HAN assessors are responsible for the assessment, the final grades always result from a thorough discussion with the industry and external supervisor. The panel highly appreciates that external examiners are present at final-assessment

sessions, which is an oral Criterion Focussed Interview (Dutch: Criterium Gericht Interview, CGI). The examination committee supervises the assessment of the graduation project by one member regularly being involved in the final assessment and by a final screening of randomly selected graduate portfolios. Workplace and external supervisors are always asked to fill in an evaluation form following the graduation session. They indicate that the graduate meets the professional profile. In these evaluation forms, workplace and external supervisors as well as students are also questioned on various quality aspects of the graduation project and assessment. MLS prepared an information guide for supervisors, a template for the gradation portfolio and a guideline for the viva. MLS believes that this will help to clarify expectations and to better understand the process of the graduation sessions in 2022. Together with the consequent usage of the 4-eyes principle, calibration sessions amongst examiners, assessment training for examiners and sampling of the final projects by the board of examiners, the panel concludes the quality of the final project is guaranteed as well as the Master final level.

Standard 4 Achieved learning outcomes

The program demonstrates that the intended learning outcomes are achieved.

Conclusion

Based on the considerations mentioned below, the audit panel assesses that Master Molecular Life Sciences study program **meets** the generic quality requirements for standard 4.
The panel concludes that all final master qualifications are assessed during the graduation project. Next to assessing scientific skills, the graduation assessment ensures students to pay sufficient attention to the managing project competencies. The panel appreciates this specific profile, with both scientific and project management skills.
The panel has seen that graduation products are of high (Master) final level, useful and relevant. The panel agrees that the nature of the graduation assessment guarantees that the professional profile is reflected by the graduates. The workfield (involved in the final assessment) thinks the same. Both alumni and the workfield representatives told the panel they are very satisfied with the reached final level of graduates and their functioning in the workfield. They find that the strong program gives students a head start in their career.

Substantiation

Graduation process

The graduation project is the integrated test of the achievement of the MLS final qualifications, including both scientific justification and managing projects competencies. The current curriculum and graduation assessment assure that the profile is well reflected by the graduates. Throughout the curriculum of 120 ECTS, students train their skills in both R&D and managing projects in the professional environment. They must demonstrate a certain level of competency before permitted to start their graduation project, to guarantee they can perform at master level throughout the gradation project. In addition, the graduation assessment ensures them to pay sufficient attention to the managing project competencies, which are prone to be a bit neglected in science-driven environments.

The panel concludes that all final master qualifications are assessed during the graduation project. For student cohorts 2016-2018, MLS assessed the project proposal, project work, scientific project report, project reflection, as well as presentation and defence in one integral cumulative assessment form. The presentation and defence integrally focussed on scientific and project management aspects of the graduation project. MLS noticed that with this assessment setup, the project management competencies applied throughout the project received less attention, both by students throughout the project, as well as by the assessors during the defence. To better reflect the graduate profile in the final assessment, MLS changed the setup to ensure that the managing project competencies gain more attention. Starting with the student group of 2019, students are separately assessed for their project proposal, their project work, the scientific report, as well as their project management (by means of a portfolio and assessment). In the portfolio, students address how they managed their project and reflect on their role throughout the project. During the final assessment meeting (viva), they pitch their project results, after which examiners ask questions focussing on major decisions taken during the project. MLS clearly sees that this setup leads to a better assessment of the managerial aspects of the project, and overall resulted in more project ownership by the student. The panel agrees with this and

recognized both scientific and project management aspects in the graduation projects the panel members studied.

Graduation products
The panel found that the graduation products are of high level. The panel has studied 15 graduation projects (Dutch: eindwerken). The panel has seen many different topics in the scientific reports, which they all found to be useful and relevant. Examples are: “Detailed RHCE genotyping with the Axiom platform on a cohort of Sickle cell patients and donors from Ghana”, “The Integration of bioinformatic tools in small-drug Molecule Development” and “T cell clonality in classic Hodgkin Lymphoma recurrences” The workfield representatives who the panel spoke, were all very positive about the high level of the graduation products. They, and the panel are both very enthusiast over the project management aspects in the graduation products.

Functioning of alumni in the professional workfield
The panel agrees that the nature of the graduation assessment guarantees that the professional profile is reflected by the graduates. This is confirmed by a recent survey among alumni who started in 2016 or later. It shows that 96% of all graduates feel confident to plan and carry out/manage projects of at least 3 months, 63% even feel confident to control projects of at least 6 months. Most of the alumni have positions with more responsibility compared to a lab technician (project leader, scientist, PhD student), either in the Netherlands, Germany, Switzerland or even Indonesia. This confirms the match of the final qualifications with the needs of the international professional field. 86% of those alumni who had work experience before starting the MLS program indicated that their position, tasks and responsibilities changed since they started the program. Furthermore, graduates who did not have work experience before starting the program have similar roles and responsibilities compared to those with prior work experience. This demonstrates that the current curriculum equally enables fresh and post-experience bachelors to achieve the final qualifications. Acquiring hands-on science competences at master level, complemented with professional skills in managing projects and professional development, is challenging for students. Especially for those without prior work experience, a program of 120 ECTS is an absolute must to achieve the graduate profile, which is highly appreciated by the professional field and alumni. Both alumni and the workfield representatives told the panel they very satisfied with the reached final level of graduates and their functioning in the workfield. They find that the strong program gives students a head start in their career. The panel agrees with this.

Extension study duration to 120 EC

Criterion 1: Is the higher study load required to achieve the final qualifications in line with international standards? (Dutch original: "is de grotere studielast noodzakelijk om het in internationaal perspectief gewenste eindniveau te behalen?

Criterion 2: Is the higher study load required to achieve the final qualifications that meet the needs of the professional field? (Dutch original: "is de grotere studielast noodzakelijk om een eindniveau te behalen dat het beroepsdomein stelt?

Conclusion
Based on the argumentation mentioned below, the panel concludes that MLS meets *both* criteria and therefore the panel advises **positively** about the extension of the study duration to 120 EC.

Substantiation
Criterion 1:
Graduate profile of the Master Molecular Life Sciences.
The overarching learning outcome of the master MLS program is that graduates are able to plan and control Research & Development (R&D) project of a duration of at least three months in life sciences. To reach this final outcome, graduates combine several central skills, namely skills in research and product development, managing project and communication. In addition, students develop the ability to guide their own professional development.

Alignment of final qualifications with the internationally defined criteria for master's level.
The final qualifications of the master MLS comply with the international standard for master's programs as defined by the Dublin Descriptors. At the same time, they align with the internationally defined EQF criteria, level 7, for master's programs.

Scope of master programs in the field of life sciences.
To achieve the final qualifications at master level, graduated bachelors (both applied and academic) in the field of Life Sciences R&D need a scope of 120 EC. This is confirmed by a search for master programs in the field of Life Sciences within the Netherlands (seven masters programs are 120 EC) and internationally (four masters in the USA, UK, Denmark and Norway are also 120 EC). This comparison shows that all master programs in the field of life sciences in the Netherlands comprise 120 EC. Most international master programs in the field of Life Sciences have this scope as well.

In the past, the program was only offered to bachelors with professional experience and had a scope of 87 EC. Despite their professional experience, these students were regularly confronted with a study delay, as they needed additional learning experiences before being able to prove their graduate qualifications during their graduation project. Therefore, and to open the program to bachelors without professional experience, MLS extended the program to 120 EC in 2016. MLS experienced that this curriculum consistently enables students to achieve the final qualifications, which align with international standards, without study delay.

Criterion 2:

The professional field: the life sciences sector

The professional field is Research and development (R&D) in the life science sector, which contributes to many innovations applicable to for instance medicine, food industry or the biobased economy. Technological advances in the life sciences sector have led to an enormous increase in generating knowledge within the last decades. It is essential to translate this knowledge into new products and solutions beneficial to society in an effective and efficient way. In this process, not only considering scientific, but also legal, practical and market requirements need to be considered. Organizations feel the need to act as effectively and efficiently as possible to minimize time and other resources. This requires staff with the appropriate mindset and skills.

Staff in the life science sector

Staff in R&D in the life science sector consists of mainly:

- professionals with vocational education to practically execute life science research with little complexity (in role as lab technician)
- bachelor graduates, mainly trained at universities of applied sciences, trained to practically execute more complex life science research (in role as lab technician)
- PhD's who oversee and guide project from a scientific and strategic point of view
- master graduates, bridging the lab-technicians and PhDs by both being involved in practical execution of R&D project, and understanding the scientific, and to some extent, strategic argumentation behind project In the Netherlands, such masters programs are almost exclusively offered by academic universities and focus on the acquirement of in-depth scientific knowledge and skills enabling graduates to oversee R&D project at master level from a scientific point of view.

Role of the professional field in the setup of the curriculum

MLS closely involved their professional field in the development of the curriculum to ensure that the program content, scope, and organization match the needs of the sector. MLS did this by asking input from the members of the professional field advisory board, and from the many other formal and informal contacts MLS has in the field. In this process, it became clear that the sector needs staff at master level who can not only scientifically oversee R&D project, but is also able to contribute to their effective and efficient realization by good project management. To this final, such staff must combine scientific knowledge and skills, insights into product development phases and requirements, good practical (experimental) skills and experiences as well as project management skills. To integrate all these skills to properly plan and control project in life sciences R&D, students need to be trained in all these fields, and must have the chance to apply the skills in practice. These requirements led to the development of the current curriculum that combines a theoretical program, providing students with broad knowledge and skills in different fields of life sciences, and an in-depth training of scientific and professional skills anchored in the professional field. A scope of 120 EC was clearly seen as a requirement to educate bachelor graduates to this master profile, which is also in line with the scope of other master's programs in the field (as shown in the argumentation related to criterion 1). A comparison of the qualifications of MLS with the professional bachelor and the master of academic universities shows that the graduates of the various programs complement each other in the professional field. It also demonstrates that, although the focus of the academic and professional master programs differs, the knowledge and skills that are required for both are equally challenging and comprehensive. Therefore, MLS's

program also demands a scope of 120 EC to qualify its graduates for functions at the appropriate level.

Recognition and appreciation of the professional field
Before adopting the scope of 120 EC, the program was not eligible to freshly graduated bachelors. Post-experience bachelors following the MLS-program were regularly delayed in their graduation project, as they needed more time for the proper development of their scientific and project skills. In addition, the value of MLS was somewhat questioned by the professional field when the scope was less than 120 EC. After adopting the curriculum with a scope of 120 EC in 2016, MLS saw that the students were consistently able to achieve the graduate qualifications within the programmed study duration. In addition, this program is eligible to freshly graduated bachelors, which is in line with the mission to further expand the volume of professional masters in the Netherlands (Vereniging Hogescholen: Verdere uitbouw professionele masters). The 120 EC curriculum led to true recognition by organizations within the sector, including innovative fast-growing enterprises like Genmab and UniQure in the Netherlands, Miltenyi Biotec in Germany, and multinationals such as MSD/MSD Animal Health (Netherlands) and Hoffman-La Roche (Switzerland). These organizations repeatedly send either employees as part-time students to MLS or request interns from MLS. Recently, all members of the professional field advisory board, representing small, medium, and large enterprises in the field, confirmed that they see the scope of 120 EC as a requirement to achieve the challenging graduate profile. Thus, the higher study load required to achieve the final qualifications that meet the needs of the professional field.

Final Conclusion

Assessments of the Standards

The audit team comes to the following judgements with regard to the standards:

	Master Molecular Life Sciences
Standaard 1 Intended Learning Outcomes	Meets the generic quality requirements
Standaard 2 Teaching-Learning Environment	Meets the generic quality requirements
Standaard 3 Assessment	Meets the generic quality requirements
Standaard 4 Achieved Learning Outcomes	Meets the generic quality requirements

The judgements have been weighed in accordance with the NVAO assessment rules. On the basis of this, the panel assesses the quality of the existing Master study program Molecular Life Sciences of the HAN **positive.**

Assessment of extension of study program 120 EC

Based on the written an oral argumentation provided by MLS, the panel concludes that the existing Master study programma Molecular Life Sciences meets *both* criteria and therefore the panel advises **positively** about the extension of the study duration to 120 EC.

Recommendations

The audit panel has a recommendation for the study program MLS.

Standard 3
The panel recommends to consistently use the remarks field in the assessment forms of the final assessment to provide each student with more elaborate feedback. Doing so will also make it clear(er) what the motives were of the examiners in reaching their collective judgement.

Appendices

Appendix 1: program for the site visit

Time	Interview/Topic	Participants
9.00 – 9.15	Welcome and panel preparation	
09.15 – 9.45	Pitch and questions	Three students (two part-time one full-time) present a 10 minutes pitch: experience with the education program 3 members of the MMLs Core team Director and member responsible for MMLS of the MT School of Applied Biosciences and Chemistry:
9.45 - 10.00	Break	-
10.00 – 11.00	Interview with lecturers	7 lecturers
11.00 – 11.15	Break	-
11.15 – 12.15	Interview with students	part-time student, 2nd yr, works at University of Antwerp part-time student, 2nd yr, works at HAN BioCentre full-time student, 2nd yr, intern at Radboud UMC full-time student, 2nd yr, intern at MSD Animal Health full-time student, graduated start 2020, intern Keygene part-time student, graduation start 2020, works at NYtor
12.15 – 13.00	Lunch and panel discussion	-
13.00 - 13.45	Interview workplace learning	2021 graduate fulltime, Project Leader Biotechnology Solutions, MSD Animal Health student 2nd yr, part-time, works at Roche Switzerland, will join online from Basel student 2nd yr, full-time, internship at Radboud UMC Workplace supervisor of 2nd yr student, Molecular Partners (Switzerland), will join online from Zürich Workplace supervisor of 2nd yr student, Labmicta Workplace supervisor of 2022 graduate, Future Diagnostics Member MMLS core team, tutor, in charge of overall regulations regarding workplace learning
13.45 – 14.00	Break	-
14.00 - 14.45	Interview Graduate level	Alumnus 2019, PhD Student at Miltenyi Biotec / Georg-August-Universität Göttingen (Germany) Alumnus 2019, Manager Assay Development at Enzyre BV Workplace supervisor, Keygene. Workplace supervisor, Dutch Cancer Institute, External supervisor graduation assessment, Associate Professor Radboud UMC External supervisor graduation assessment, Senior Director Process Development, Intravacc Member MMLS core team, lecturer/tutor, (graduation) assessor
14.45 – 15.00	Break	
15.00- 15.45	Interview quality monitoring	Member of Program Committee, lecturer Member of Program Committee, 2nd yr student Chair Examination Board of SABC Member ExamBoard and Assessment Evaluation Committee, MMLS core team (core team safeguards the curriculum) Two members of the Professional Field Advisory Board, Manager Scientific Support at Enzyre BV/Director Operations at MSD Oss Quality advisor of the MMLS program
15.45 – 16.00	Break	-
16.00 – 16.30	Discussion with Management team	3 members of the MMLS core team Director and member responsible for MMLS of the MT School of Applied Biosciences and Chemistry:
16.30 – 17.15	Panel discussion	Panel
17.15 – 17.30	Feedback and findings panel	3 members of the MMLS core team: Marloes Vissers, Remko Bosch, Andrea Thiele Director and member responsible for MMLS of the MT School of Applied Biosciences and Chemistry:

Appendix 2: examined documents

- 5 Annual reports, Board of examiners (Gezondheidszorg HMP and ATBC, 2016 – 2020)
- Information about staff 2022
- Degree Statute and Education and Examination Regulations of the Masters degree, course Molecular Life Sciences 21-22
- Description of units of study 2021-2022
- 5 Graduation Handbooks (2016 – 2020)
- Complete list of graduates
- 4 student evaluations of 4 different courses
- Summary evaluations 2018 - 2022
- Declaration professional field advisory board
- Institutional Plan HAN, 2022 – 2028
- Reader Workplace Learning, 2021 – 2022
- Relation competences – curriculum 2021
- Relation BoKS – curriculum 2021
- MMLS Study duration and output, 2016 onwards
- Overview of study load
- Guideline exemption based on work experience 2021
- Education plan MMLS, 2021 – 2022
- 12 minutes didactics MMLS
- Toetsbeleidsplan MMLS 2021 – 2022
- Minutes Advisory Board MMLS
- Final qualifications, updated January 2022
- MMLS Alumni survey 2022
- Comparison final qualifications
- De professionele Masterstandaard, Vereniging Hogescholen, Juli 2019
- Verdere uitbouw professionele Masters, Vereniging Hogescholen
- Argumentation extension study duration, comparison final qualifications
- Argumentation extension study duration DS EER MMLS 2022-2023
- Argumentation extension study duration Declaration professional field advisory board
- Argumentation extension study duration HAN MMLS

Graduation documents studied:

- 6x graduation documents, old style
- 9x graduation documents, new style